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Desalination amendments: EXTERNAL PEER REVIEW OF A PROPOSED AMENDMENT TO THE WATER QUALITY CONTROL PLAN FOR CALIFORNIA OCEAN WATERS TO ADDRESS DESALINATION FACILITY INTAKES, BRINE DISCHARGES, AND TO INCORPORATE OTHER NONSUBSTANTIVE CHANGES

I have reviewed the Water Quality Control Plan for ocean waters of California along with the associated Draft Staff Report (and other documents as necessary) focusing particularly on the proposed amendments in relation to control of the intake of seawater for desalination facilities. Overall, I believe that the best available scientific information has been used to inform the proposed amendment. Where information was lacking, a number of studies have been undertaken. There have also been several reviews of available information that have helped inform the proposed amendments. In addition, I was impressed that consideration had been given to cumulative effects on marine life from past, present and reasonably foreseeable future activities. Potential cumulative impacts are not always addressed. Below are my comments in relation to the specific conclusions that constitute the scientific basis of the proposed regulatory action.

1. A receiving water salinity limit of two parts per thousand (ppt) above natural background salinity is protective of marine communities and beneficial uses.
The impacts of salinity on marine organisms are species dependent but as indicated in the Staff report marine organisms generally start to show signs of stress when salinity is increased by 2-3 ppt. An exception may be seagrasses which are more sensitive. Most of the studies have focused on potential lethal effects and there are very few investigations of sublethal effects. The lethal effects of brine on marine environments can be minimal if disposal is properly undertaken and managed as dilution can be rapid in a suitable environment. Overall, a water salinity limit of 2 ppt should provide adequate protection of marine environments in terms of lethal effects. The key thing to consider is likely the need for accurate calibration of salinity testing equipment and verification against standards to ensure that any salinity measurements are accurate and capable of detecting a 2 ppt change.

2. A subsurface seawater intake will minimize impingement and entrainment of marine life.
There is clear scientific evidence to suggest that subsurface intakes will minimise impingement and entrainment of marine organisms since they generally collect water through sand sediment. However, subsurface intakes may not be able to be used in all locations therefore knowledge of the local geologic conditions is required. The proposed amendments have considered this factor and acknowledge that site and facility-specific factors be evaluated before deciding on the best method of seawater intake.

3. A 0.5 mm, 0.75 mm, 1.0 mm, or other slot sized screens installed on surface water intake pipes reduces entrainment.
Various slot sizes are possible for surface water intake pipes and a number of studies have evaluated effectiveness of mesh screens at reducing impingement and entrainment of marine organisms. As indicated in the staff report species morphology

needs to be considered – this can likely be modelled and then further investigated empirically. Knowledge of the fish assemblage at the locality of the desalination facility will be critical to assess the efficacy of different slot screen sizes. For surface water intake pipes there is sufficient evidence in the literature to support the use of slot sized screens to reduce entrainment. However, the size of screen (and performance of screens) may need to be considered on a location by location basis. In addition there may be some variation through time due to differences in larval assemblages. These factors have been considered in a number of the reports.

4. Multiport diffusers and commingling brine with other effluents can dilute brine discharge and provide protection to aquatic life.
Commingling brine with other waste discharges has been shown to be one of the most effective methods for brine discharge, but as indicated in the report is not always feasible. Of the other methods, to date, discharging brine through multiport diffusors is likely to provide greatest protection to aquatic organisms as background salinity is reached relatively close to the output. Both approaches can dilute brine discharge and have the potential to minimise impacts on marine organisms when properly utilised.

5. The Area Production Forgone (APF) method using an Empirical Transport Model (ETM) can effectively calculate the mitigation area for a facility's intakes.
I am not familiar with many of the approaches to mitigating for desalination-related impacts. However, based on my knowledge of fish life history I agree that the Adult Equivalent Loss (AEL) and Fecundity Hindcasting (FH) approaches are likely to be difficult to implement due to the lack of information on growth and survivorship of species at different stages of their life history. As such, for many species there would be insufficient data to evaluate AEL or FH approaches. Given that the empirical transport model and area of production forgone method relies on oceanographic and entrainment data it is more easily calculated for estimation of mitigation. Estimates of production forgone are also used in other areas for mitigation and restoration (e.g. oil spills), again supporting their use in desalination.

I have also briefly addressed the following questions:

1. In reading the Substitute Environmental Document that also comprises the Staff Report and proposed amendment language, are there any additional scientific findings that are part of the scientific basis of the proposed rule not described above?
The amendments consider the key marine environmental impacts, namely impingement and entrainment of organisms due to intake of water, and the concentrate and chemicals that are discharged to the marine environment as a result of the process. I believe that the key scientific findings have been adequately described.

2. Taken as a whole, is the scientific portion of the proposed rule based upon sound scientific knowledge, methods, and practices?
Overall, the scientific section uses sound scientific knowledge, methods and practices. In particular, consideration of potential cumulative impacts of the desalination facility in combination with other anthropogenic factors is important. This will allow effects of multiple desalination plants to be considered as well as the effect of a desalination plant placed nearby other facilities (e.g. power plant, waste water treatment plant etc).

The proposed amendments take into account best scientific practice but also provide flexibility to meet project goals and minimise marine impacts as much as possible.

END of REVIEW

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